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regret that this opportunity should have been so lightly passed over by a writer with every appearance of unusual fitness to improve it.

FREDERIC LYMAN WELLS

SCIENTIFIC JOURNALS AND ARTICLES

The Internationale Revue der Gesamten Hydrobiologie und Hydrographie published at Leipzig with an editorial board consisting of Dr. Bjorn Helland-Hansen (Bergen), Professor George Karsten (Halle), Professor Charles A. Kofoed (Berkeley), Professor Albrecht Penck (Berlin), Dr. Carl Wesenberg-Lund (Copenhagen), Professor Friedrich Zschokke (Basel) with Professor R. Woltereck (Leipzig) as editor-in-chief, has with the beginning of volume 3 enlarged its scope and modified the form of its publication. In addition to the *Revue* proper, which will be issued in six parts per year forming an annual volume of 600 pages, there will be also biological and hydrographical supplements, forming annual volumes of 300 pages each, a *Jahresbericht* of literature in the hydrobiological and hydrographical fields, of about 300 pages, and a quarto series of monographs. The *Revue* proper will contain shorter original articles, critical summary of special fields of investigation, reviews of pertinent literature from various countries and of important works, news items regarding biological stations, expeditions, university instruction in the field of the *Revue*, etc. The supplement volumes will contain the more extensive papers with plates and the monograph series, the still larger reports of expeditions, lake surveys, etc., and the more extensive biological memoirs. Contributions for the journal and papers for review may be sent to the American editor, Professor Charles A. Kofoed, Berkeley, California, or directly to the Editor-in-Chief.

SPECIAL ARTICLES

THE SARGASSO SEA

SOMEWHAT more than fifty years ago, Maury¹ announced that midway in the At-

¹M. F. Maury, "Physical Geography of the Sea," new edition, New York, 1856, pp. 30, pl. vi.

lantic, in a triangular space between the Azores, Canaries and Cape Verde islands, the sargasso sea embraces an area equalling the Mississippi Valley in extent and so thickly covered with gulf weed that the speed of vessels is often impeded. To the eye at a little distance it seems substantial enough to walk on. His map represents the area of weed as shaped like an hourglass, with the broader space toward the west. It extends from 19° to 66° west longitude, the eastern portion from 17° to 30° and the western from 22° to 28° north latitude.

A few years later, Ansted² said that a considerable space between 20° and 40° west longitude and 15° to 30° north latitude is sometimes so matted with brownish weed as to hide the water, resembling a drowned meadow on which one can walk. It holds trees and plants from the Mississippi and Amazon.

Thomson³ does not define the limits of the sargasso sea, but places the northern border near the Azores. He seems to think that it extends to south from the Bermudas. The floating islands of gulf weed are usually from a couple of feet to two or three yards in diameter, but he saw on one or two occasions fields several acres in extent; and he thinks that such expanses are probably more frequent near the center of the area of distribution. They consist of a single layer of feathery bunches of *Sargassum bacciferum*, not matted but floating nearly free of each other, only enough entangled for the mass to keep together.

Carpenter⁴ limited the area more closely, for he says that the sargasso sea is comparatively still water between 30° and 60° west longitude and 20° and 35° north latitude, into which is gathered a considerable portion of the drift or wreck of the north Atlantic.

²D. F. Ansted, "Physical Geography," 2d. ed., Philadelphia, 1867, p. 148.

³C. Wyville Thomson, "The Atlantic," New York, 1878, II., pp. 15, 16, 24.

⁴W. B. Carpenter, "Encyclopedia Britannica," 1887, III., p. 20.

The indefinite descriptions of the area and mass of seaweed, as well as the extraordinary statements made by some authors in discussing the origin of coal, induced the writer to make an examination of the conditions for himself. The matter is easy, because the steamship route between Barbadoes and the Azores crosses the area diagonally and passes very near the center. In going from Barbadoes to the Azores the steamer crossed—

North latitude	21° 8'	at	50° 17'	west longitude.
	24° 39'		46° 2'	
	27° 44'		41° 36'	
	30° 53'		36° 57'	
	33° 58'		31° 57'	

In returning from the Azores to Barbadoes the crossings were

North latitude	21° 46'	at	48° 18'	west longitude.
	24° 59'		44° 4'	
	28° 3'		39° 57'	
	31° 8'		35° 28'	

The return course being approximately two degrees east from the outward route. On the twenty-seventh parallel the line is very near the center of the usually accepted area as defined by Carpenter. Returning, the steamer passed by daylight much of the area passed by night on the outward passage.

On the outward passage, the first seaweed was seen just north from the twenty-first parallel, but only a few isolated bunches, 6 to 12 inches in diameter. As the twenty-third parallel was approached, weed became more abundant and the quantity increased until nightfall, when the twenty-fifth was crossed. The bunches, all well isolated, were from 5 to 18 inches in diameter and occasionally they occurred in lines 50 or more feet long. During much of the day, the number of bunches averaged about a score to the acre and frequently there were spaces 1,000 feet wide, without any trace of weed. On the twenty-sixth parallel, the weed was comparatively abundant, but it was still in separated bunches, though one patch was observed about 6 feet square. The arrangement ordinarily is linear, following the direction of the

wind, approximately northeast and southwest; sometimes there is a long line of single bunches while at others there are strips 3 to 10 feet wide; but the intervening spaces of 100 to 500 feet are almost weedless. On the twenty-seventh parallel, the ship was in west longitude 41° 36', therefore almost central in the sargasso, but there the weed had practically disappeared. Occasionally a short line was seen but the ship many times passed 1,000 feet with no trace. Beyond the twenty-eighth parallel the number of bunches averaged about 25 per hour, while beyond the thirty-first one sees only an occasional fragment.

On the return voyage, seaweed seemed to be absent until the twenty-eighth parallel was reached at west longitude 40°, where a few bunches were seen. No more was observed until the twenty-third parallel at west longitude 45°, where some lines of single bunches were crossed. Beyond that not more than 30 bunches, all told, were seen until Trinidad was reached.

During the voyage from Barbadoes to the Azores, the writer had opportunity to gain important information from two officers who had crossed the sargasso sea many times. Captain W. J. Dagnall, of the R. M. S. P. steamship *Orotava* was long in charge of a steamer plying between Jamaica and Southampton, a route much farther west than between Barbadoes and the Azores, as it crosses the twenty-seventh parallel 750 miles away, but thence the routes converge. Along this western line the seaweed is often abundant, but neither there nor on the Barbadoes-Azores route did he ever see a patch of weed exceeding an acre in extent. Much depends on the time of year, for weed appears to accumulate while the trades are mild and to be broken up later in the season when the strength of the winds increases. In any case, however, the weed occupies only a small part of the area, the patches being separated by wide spaces of clear water, almost free from weed. Many of the bunches show unmistakably that they had been attached to rock; and the plants have traveled far, since in a large

proportion of bunches only a part is living, the dead parts being of a brownish color.

Captain Dagnall's statements were confirmed by Captain George Morrison of the R. M. S. P. steamship *Berbice*, who had been in charge of steamers between Jamaica and Southampton as well as of a steamer plying between Jamaica and the Canaries. But he thinks that patches of weed one acre in extent are very rare, and he was unwilling to assert that he had ever seen one larger than half an acre. In his opinion the gulf weed is torn off from the Bahamas by the waves and the greater part of it is swung around those islands. The writer's own observations agree with this, for in passing through the Bahama archipelago along the seventy-fourth meridian, he found the seaweed much more abundant than along either of the lines followed across the sargasso. The weed is evidently the same, being in circular bunches up to 18 inches diameter arranged in strips according with the direction of the wind, though occasionally in bands or even in patches 8 by 10 feet. The patches are near the large islands.

Seaweed occurs abundantly off the coast of Venezuela. It comes from the borders of the Orinoco delta and it was seen on the return voyage at about west longitude 62°. Thence it was very abundant to near the sixty-sixth meridian, where it disappeared abruptly and no more was seen except a small area near the seventy-second. The abrupt disappearance is difficult to explain; it is not due to decay, for the last exhibition was of apparently fresh weed; the distance from the source is too small to justify the supposition of decay, for the gulf weed is still living after having traveled from the Bahamas round to the east side of the sargasso. This is not the gulf weed, to which it bears no resemblance.

At best, the quantity of weed seen at any locality is wholly insignificant. Midway in the sargasso sea, the bunches seen in a width of a mile would form, if brought into contact, a strip not more than 65 feet wide. This, where the weed is most abundant. But the bunches are very loose, the plant material, as was estimated, occupying less than one fifth

of the space, so that if the bunches were brought together so that the plant parts would be in contact, each square mile would yield a strip not more than 13 feet wide and 3 or 4 inches thick, or barely 2,500 cubic yards of uncompressed seaweed to the square mile. In most of the area traversed, the quantity would be but a small fraction of 2,500 cubic yards to the square mile—and the conditions are the same along the lines described by Captains Dagnall and Morrison. The accumulation of decayed vegetable material from seaweeds must be comparatively unimportant under the sargasso sea; and what there is would be merely foreign matter in mineral deposits.

The trade winds are comparatively gentle in early July, and the latter part of August, when the writer made the voyages; but they are sufficient to raise waves of five to eight feet and the sea is covered with "white caps." Later in the season the winds become much stronger. Reasoning *a priori*, one can hardly conceive it possible that, with the water in constant motion, the floating débris could accumulate *en masse* over any considerable area; even should such accumulation take place during a period of comparative quiet so as to protect the water from wind, it would soon be broken up by wave attacks along the borders; for the patches of weeds are not matted like peat—they are merely agglomerations of loose bunches drifted together.

JOHN J. STEVENSON

IS THERE DETERMINATE VARIATION?

UNDER this title I published in *SCIENCE* four years ago¹ a paper discussing the changes from year to year in the color pattern of the beetle *Diabrotica soror* as these changes had been observed by me during the decade 1895–1905. The observations depended on the collection each year (1896–1900 omitted) at approximately the same time and place (in the later years two separate places each year) of series of 1,000 individuals, and the determination and tabulation of the color-pattern

¹ Vol. XXIV., pp. 621–628, November, 1906.